15.3-1 NEAR-EDGE FINE-STRUCTURE OF LOW-Z ELEMENTS BY INELASTIC SCATTERING OF 5-20 keV SYNCHROTRON X-RAYS. By W. Schülke and H. Nagasawa, Institute of Physics, University of Dortmund, Fed. Republic of Germany

The structural information that can be extracted from the near-edge fine-structure will make synchrotron X-ray photoabsorption measurements a valuable tool for in-situ investigations of structural changes under special conditions (temperature, pressure) and environments (substrates, gases, fluids, anvils). But, till now, it were both these environmental conditions and the necessity of bulk specimens that prohibited measurements of edges of low-Z elements being done in this kind of experiments. It has been shown experimentally that the edge structure of Li- and Be-metal and of carbon in graphite, as obtained with 1 eV resolution by means of inelastic scattering of 8-keV synchrotron X-rays, is identical to the corresponding VUV-absorption edge, where the momentum transfer $\vec{q}$ of the scattering experiment plays the role of the polarization vector of the absorption measurement. Thus in-situ investigations of the near edge fine structure of low-Z elements become feasible under conditions, where both the photoabsorption of VUV-radiation by the environmental elements and bulk specimens would prevent VUV absorption edge measurements. The detection sensitivity is estimated in the light of forthcoming new dedicated synchrotron X-ray sources.

15.4-1 RDF STUDY OF Ge-As-Se GLASS EMPLOYING ANOMALOUS SCATTERING. By A. Nukui, Y. Shimizugawa*, H. Morikawa* and Y. Hasegawa**, National Institute for Research in Inorganic Materials, *Tokyo Institute of Technology and **Hitachi Co. Ltd., Japan.

Structural studies on Ge-As-Se glasses of $Ge_{0.3}As_{0.1}Se_{0.6}$ and $Ge_{0.3}As_{0.3}Se_{0.4}$ are performed by measuring Radial Distribution Functions (RDF) employing anomalous dispersion effects at the Ge, As and Se absorption edges. Intensity data were taken by X-rays from the Synchrotron Radiation Source at the KEK, Japan. Measurements were carried out at four different wavelengths;

λ_1 = 191917A (far from three absorption edges)
λ_2 = 1.1185A (Ge absorption edge, 1.1165A)
λ_3 = 1.0478A (AS absorption edge, 1.0450A)
λ_4 = 0.9807A (Se absorption edge, 0.9807A).

Average atomic distances and coordination numbers in each glass were determined by RDF using only X-rays of λ_1 and compared with the results by Poltavtsev et al. (Inorg. Mater., Consultants Bur. Transl., 1975, 10, 1659). Interference function curves, which were deduced from a couple of intensity data measured by the X-rays far from and at the absorption edges of Ge, As and Se, were Fourier-transformed to lead to Partial RDF's in which the environment around Ge, As and Se was emphasized. Peak heights and profiles in the Partial RDF for Ge, As or Se are different slightly to each other, especially beyond 4A. From those Partial RDF's the structural conformations of the tertiary Ge-As-Se glasses will be discussed on the basis of recent studies of the binary Ge-Se glasses (i.e. Nukui et al., KEK Activity Report, 1985/86).

15.4-2 THE INTERFERENCE FRINGE DUE TO X-RAY RESONANT SCATTERING. By M. Yoshizawa, T. Kawamura*, K. Ehara, T. Nakajima**, H. Sugawara, T. Fukamachi and K. Hayakawa***, The Saitama Institute of Technology,
* Department of Physics, Yamanashi University,
** Photon Factory, National Laboratory for High Energy Physics, *** Advanced Research Laboratory, Hitachi Ltd., Japan.

The fringe caused by the interference between the incident and diffracted x-rays is observed for a perfect crystal in the Laue case, which is known as Pendellösung. It has been observed in the diffraction pattern for a wedge-shaped crystal (N. Kato and A.R. Lang; Acta Cryst., 12, 787 (1959)) and in the diffracted intensities as a function of the incident x-ray wavelength (T. Takama, M. Iwasaki and S. Sato; Acta Cryst., A36, 1025 (1980)). We have studied theoretically another type of interference fringe which is caused by change of the real part ($f'(\omega)$) of x-ray anomalous scattering factor around the absorption edge (T. Kawamura, M. Yoshizawa, T. Fukamachi and H. Sugawara; SSRL Rep., 85-02, 36 (1985)).
In this paper, we report on the experimental results of the intensity modulation in the integrated reflection intensity. We measured the energy-dispersive integrated reflecting intensities by using synchrotron radiation at Photon Factory in National Laboratory for High Energy Physics, Japan.
The samples are GaAs perfect crystals of 150 and 200 µm thickness. Figs. 1 and 2 show the results of 200 reflection intensities near the Ga K absorption edge. The open circles are measured intensities and the solid lines are the calculated ones. The calculation is based on dynamical theory of x-ray diffraction with absorption effect into account. The result in each figure shows the intensity modulation in the integrated intensity by the interference as a function of $f'_{Ga}(\omega)$ through the change of energy around the edge. Two peaks in the intensity curve for a crystal of 200 µm thickness are clearly observed both in theory and experiment. The intensity modulation in the integrated reflection intensities between Figs. 1 and 2 are very different, which is a combined result of the variation in thickness and $f'_{Ga}(\omega)$. These experimental results confirm that the interference fringes are due to x-ray resonant scattering.

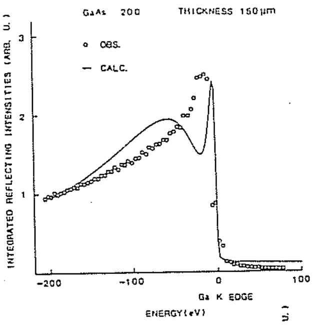

Fig. 1
The integrated reflecting intensities of 200 from GaAs crystal near the Ga K absorption edge.
The thickness is about 150 µm.

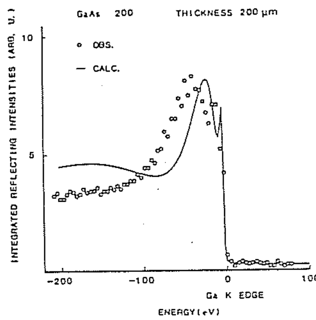

Fig. 2
The integrated reflecting intensities of 200 from GaAs crystal near the Ga K absorption edge.
The thickness is about 200 µm.